NOTES ON THE TAXONOMY OF NUDIBRANCHIATE MOLLUSCA FROM THE PACIFIC COAST OF NORTH AMERICA.

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I. On Cavolina crassicornis and C. subrosacea, of Eschscholtz.

In 1831 Eschscholtz described three Nudibranchs collected by Captain von Kotzebue in Alaska in 1824, the first to be recorded from the Pacific Coast of North America.

A. *Cavolina crassicornis.*

The second of these he named *Cavolina crassicornis*, and in view of the rarity and consequent inaccessibility of his work it may be permissible to quote from it in some detail.

" Corpore pallido; capite tentaculisque anticis crassis flavis; collo lineis tribus rubris; appendiculis dorsalibus atris apice rubris.

" An der Nordwestküste Africa's [*sic*] an der Insel Sitcha wo diese Art auf breitem Seetange und Ulven lebt.

" Länge drei Zolle. Der Leib hell hornfarben, der Rücken blass grau, Kopf und vordere Fühler gelb; letzere sind an ihrer Wurzel sehr dick und übertreffen die hintere stark geringelten braunen Fühler, welche eine gelb, Spitze haben, an lange beträchtlich. Auf der obern Fläche der vordern Fühler beginnt von der Spitze ein gelber Streifen und setzt sich auf den Nacken fort, wo er sich sehr breit wird und allmälig eine perlblaue Farbe annimmt; auf der mitte des Nackens eine brennend oranger Streifen, an gleicher an jeder Seite; jeder orange Streifen ist von einer weisen Linie eingefasst. Auf der Mitte des hell hornfarbenen Rückens bemerkt man eine Stelle unter welcher das Herz pulsirt; über den ganzen Rücken bis zur Schwanzspitze erstreckt sich ein perlmutterfarbener Streifen. Der kiemenartiger Fortsätze an den Seiten des Leibes unterscheidet man vier bis funf Bündel; jeder einzelne Fortsatz ist 2–4 Linien lang, an der ganzen untern Seite hornfarben, oben schwarz mit einem breiten weissen Längsstreifen und breiter oranger Spitze. Auf dem platten weissen Schwanze bemerkt man ausser der mittlern Linie noch zwei weisse Längsstreifen. Auch der hornfarbige Fuss hat eine weisse Randlinie.

" Die abgefallenen kiemenartigen Fortsätze, welche sich leicht lostrennten . . ."

From the itinerary and the context it is obvious that " Nordwestküste Afrika's " is a misprint for " Nordwestküste Amerika's ", and the island referred to is Sitka, Alaska.

Gray (8) in 1857 placed this form in the genus *Facelina*, but Trinchese (13, p. 31) pointed out in 1881 that this was not justified

for several reasons. The same author criticizes Eschscholtz's account of the species, and concludes, " Evidentemente, la figura di Eschscholtz è falsa, e deve perciò essere eliminata dal materiale scientifico." This sweeping statement is hardly necessary, and, as will be pointed out below, the description furnished by Eschscholtz was the most complete in some respects that was given for seventy years.

In 1862 Cooper (5, p. 205) described a species *Æolis* (*Flabellina*) *opalescens* with an opaline colour on the dorsal tentacles and an orange stripe between them (cf. Eschscholtz). Again, in 1863 (6, p. 60), the same author also records this species as *Flabellina opalescens*, mentioning a pale variety with white tipped branchiæ (*i.e.* cerata).

Bergh in 1878 (1, p. 573), and again in 1879 (2, p. 81), formed a new genus *Hermissenda* for this species. It is closely allied to *Phidiana*, but differs in the produced angles of the foot, the form of the teeth, but especially in the absence of a hook on the penis, and in these papers he identifies the *Æolis* or *Flabellina opalescens* of Cooper as *Hermissenda opalescens*, the only member of the genus. The rhinophores are stated to be yellow with an orange stripe between them (cf. Eschscholtz). The papillæ are yellow with the purple red liver diverticulum shining through.

Cockerell in 1901 (3, p. 122) also described the same form, calling attention to the two " opal blue " lines on the back forming practically one, but dividing on the head and just behind it to admit " a bright orange streak ". He also mentions the " broad orange stripe on each side of the head ", the fact that the cerata possess an " orange subterminal ring ", and that they are " easily deciduous " (*cf.* Eschscholtz).

The same author in conjunction with Eliot in 1905 (4, p. 50), but strangely enough without reference to his previous paper, again dealt with this species. This paper also mentions the " opalescent stripe down the back, bifurcating anteriorly so as to include an oblong area of bright orange ".

The first full account of the coloration of this species was furnished by O'Donoghue in 1921 (9, pp. 201, 202), but at the time the paper was written the author had overlooked Cockerell's paper of 1901 for the reason given above, and had not access to Eschscholtz's atlas. A second paper by the same author (10) deals with the range of colour variation met with in the same species. In the two papers practically every point in regard to colour mentioned by Eschscholtz is also described: the opalescent line along the back bifurcating at the front to include a bright orange area and then passing on to the oral tentacles; the orange area on each side of the head and neck; the light-coloured opalescent line below this area; the interior of the cerata may be almost black, and they have a white line on their outer border; the cerata in the dark varieties

have a deep orange tip; the two lateral light lines in the tail region and the light opalescent line along the margin of the foot.

These points are taken from O'Donoghue and arranged in the order in which they are dealt with by Eschscholtz, and I think it will be obvious at once that such a closeness of description makes it certain that the same species is under consideration in both cases. If only the intervening observers had given a more precise account of the colour of the living animal I think the identity of *Cavolina crassicornis* and *Hermissenda opalescens* would have been established earlier. Examination of the radula shows that Bergh, Cockerell and Eliot, and O'Donoghue were all dealing with the same species. The name *opalescens*, therefore, must be discarded in spite of its familiarity and of the fact that it describes the characteristic opalescent appearance of the lines of this beautiful species so well, and the name *crassicornis* substituted for it.

The classification and synonymy of this form is therefore as follows:—

Family ÆOLIDIDÆ, Eliot, 1910.

Genus HERMISSENDA, Bergh, 1878.

Species *Hermissenda crassicornis*, Eschscholtz, 1831.

Synonymy: *Cavolina crassicornis*, Eschscholtz, 1831.
Facelina (*Cavolina*) *crassicornis*, Gray, 1857.
Æolis (*Flabellina*) *opalescens*, Cooper, 1862.
Flabellina opalescens, Cooper, 1863.
Hermissenda opalescens, Bergh, 1878, 1879.
Facelina (*Cavolina*) *crassicornis*, Trinchese, 1881.
Hermissenda opalescens, Cockerell, 1901.
" " Cockerell & Eliot, 1905.
" " O'Donoghue, 1921, 1922.
" " O'Donoghue & O'Donoghue, 1922.

B. *Cavolina subrosacea*.

This was the third of the Alaskan forms described by Eschscholtz, and was also found on Sitka Island. The figure of this species is poor and the description very brief. From this account it is only necessary to quote the following points: "Die vordern Fühler fein" (*i.e.* oral tentacles)—"die hintern Fühler sehr schwach geringelt" (*i.e.* the rhinophores)—"das vorderer Ende der Fussplatte ist jederseits mit einem flügel-artigen anhange versehen."

The original genus *Cavolina*, Cuvier, comprised forms with non-perfoliate rhinophores and rounded angles on the foot, so that this species was not accurately referred to the genus by Eschscholtz. Gray (8) included this with the foregoing species in the genus *Facelina*, and in the same way Trinchese (13, p. 31) pointed out "Nemmeno la *Cavolina subrosacea* di Eschscholtz deve essere

compressa nel genere *Facelina* ", but he does not suggest where it should be placed.

The original description is incomplete, and the illustration also is not good, but the form does not appear to have been found subsequently, and so we have only this to go upon. In the absence of further details, particularly of the radula, it is hardly possible to place this form accurately, but in the possession of fine oral tentacles, produced angles on the foot, and feebly perfoliate rhinophores, it agrees with certain members of the genus *Coryphella*. Pending its rediscovery and more accurate description, it would seem advisable to include it in this genus.

The classification and synonymy of this form is therefore as follows :—

Family ÆOLIDIDÆ, Eliot, 1910.

Genus CORYPHELLA, Gray, 1857.

Species *Coryphella subrosacea*, Eschscholtz, 1831.

Synonymy : *Cavolina subrosacea*, Eschscholtz, 1831.
Facelina (*Cavolina*) *subrosacea*, Gray, 1831.
" " " Trinchese, 1881.

List of References.

1. Bergh, R., Beitr. zur Kenntn. den Aeolidiaden, vi. Verh. k.k. Zool.-bot. Gesell. Wien, xxviii, 1878.
2. Ibid., " On the nudibranchiate Gasteropod Mollusca of the North Pacific Ocean, with special reference to those of Alaska " : Proc. Acad. Nat. Sci. Philad., 1879, pt. i.
3. Cockerell, T. D. A., " Notes on Two Californian Nudibranchs " : Journ. Malacol., vol. viii, No. 4, December, 1901.
4. Cockerell and Eliot, C., " Notes on a Collection of Californian Nudibranchs " : Journ. Malacol., vol. xii, pt. iii, 1905.
5. Cooper, J. G., " Some new genera and species of California Mollusca " : Proc. Califor. Acad. Sci., vol. ii, 1862.
6. Ibid., " New or Rare Mollusca inhabiting the Coast of California, Pt. II " : Proc. Califor. Acad. Sci., vol. iii, pt. i, 1863.
7. Eschscholtz, F., " Zoologischer Atlas," Viertes Heft, 1831.
8. Gray, J. E., " Guide to the systematic distribution of Mollusca in the British Museum," pt. i, 1857.
9. O'Donoghue, C. H., " Nudibranchiate Mollusca from the Vancouver Island Region " : Trans. Roy. Canadian Inst., vol. xiii, No. 1, 1921.
10. Ibid., " Notes on the Nudibranch Mollusca from the Vancouver Island Region. I. Colour Variations " : Trans. Roy. Canadian Inst., 1922.
11. Ibid., ibid., " III. Records of Species and Distribution " : ibid.
12. O'Donoghue and O'Donoghue, ibid., " II. The Spawn of Certain Species " : ibid.
13. Trinchese, S., " Æolididæ e famiglie affini del Porto di Genova " : pt. ii, Roma, 1881.

II. On the Genus Triopha, Bergh.

In 1863 Cooper (7, p. 59) described a new form of Nudibranch from Catalina Island, and referred it to the genus *Triopa* (presumably of Johnston) with the name *T. catalinæ*. Ten years later Stearns

(12, p. 78) described an allied form from Monterey, which he named *Triopa carpenteri*.

Abraham also cites these two species as *Triopa catalinæ* and *carpenteri* in 1877 (1, p. 230).

Bergh in 1880 (2, p. 112) discussed the generic characters of the second of these forms, and pointed out that, while it agrees with the *Triopa* of Johnston in certain characters, it, nevertheless, differs in certain important particulars, and he created for it a new genus *Triopha*, which has subsequently been accepted. At the same time he described another species *T. modesta*, but suggested that further examination might show that it was identical with *T. carpenteri*. The same author in 1894 (3, p. 184) gave a fuller description of the animal and here definitely placed *T. carpenteri* as a synonym, though I cannot understand why he did this, for obviously if the forms were identical, then the name of the species would have to be *T. carpenteri*, for this name was applied in 1873 and, therefore, had priority. However, subsequent work showed that he was in error, and the two forms are distinct.

MacFarland, in 1905 (8, p. 48), gave a preliminary account and in 1906 (9, p. 135) a more detailed description of *T. carpenteri*, in which he shows clearly that the animal, while similar to *T. modesta* in many ways, is undoubtedly specifically distinct, and both names, therefore, stand as representing valid species. In the same papers MacFarland described two new species, namely, *Triopha maculata* (8, p. 49, and 9, p. 137) and *T. grandis* (8, p. 50, and 9, p. 139).

The next authors to deal with the genus were Cockerell and Eliot in 1905 (6, p. 42), who described a specimen from San Pedro which they referred to the genus *Triopha*, but did not give any specific name, as they lacked notes on the living animal. The former author in a brief list of the Mollusca of La Jolla (5, p. 107) appends a note to say that he recovered the notes on the external characters and proposed to name the species *T. aurantiaca*. Cockerell, again, in 1915 (4, p. 228) describes yet another species, calling it *Triopha scrippsiana*, and mentions *T. aurantiaca* without, however, giving any reference to his previous paper.

In 1921, O'Donoghue (10, p. 165) examined a number of specimens of a *Triopha* which was found to be identical with the *Triopha* sp. ? of Cockerell and Eliot, and the additional data there given was thought sufficient to merit its being retained as a species under the name *T. elioti*. This name was also used in dealing with the species subsequently (11). When the above were written, the author was unaware of the note appended by Cockerell to his list of the Mollusca of La Jolla, but it is obvious from this that the true name of the species is *Triopha aurantiaca*, and *T. elioti* is to be regarded as a synonym.

The genus *Triopha* has so far only been recorded from the Pacific coast of North America, where it is represented by a series of forms

ranging from Unalaska to the south of California. Of these, *T. catalinæ* is very inadequately described, and, on the one hand, it may not belong to the genus or, on the other, it may be one of the species described subsequently. It is here included for the sake of completeness in the following list of the known members of the genus :—

Genus Triopha, Bergh, 1880.

Species : *T. aurantiaca*, Cockerell, 1908 (synonyms : *Triopha* sp.? Cockerell & Eliot, 1905 ; *T. elioti*, O'Donoghue, 1921).
T. carpenteri, Stearns, 1873.
T. catalinæ, Cooper, 1863.
T. grandis, MacFarland, 1905.
T. maculata, MacFarland, 1905.
T. modesta, Bergh, 1880.
T. scrippsiana, Cockerell, 1915.

List of References.

1. Abraham, P. S., " Revision of the Anthobranchiate Mollusca, with Descriptions or Notices of forty-one hitherto undescribed Species " : Proc. Zool. Soc., 1877, pp. 196–267.
2. Bergh, R., " On the Nudibranchiate Gasteropod Mollusca of the North Pacific Ocean, with special reference to those of Alaska. Pt. II " : Proc. Acad. Nat. Sci. Philad., 1880, pt. i.
3. Ibid., " Die Opisthobranchien " from " Reports on the Dredging Operations off the West Coast of Mexico, and in the Gulf of California in charge of Alexander Agassiz carried on by the U.S. Fish Commission Steamer ' Albatross ' during 1891 " : Bull. Mus. Comp. Zool. Harvard, vol. xxv, October, 1894.
4. Cockerell, T. D. A., " The Nudibranch-Genus *Triopha* in California " : Journ. Ent. and Zool. Claremont, vol. vii, No. 4, 1915.
5. Ibid., " The Mollusca of La Jolla, California " : Nautilus, vol. xxi, No. 9, 1908, p. 106.
6. Cockerell, T. D. A., and Eliot, C., " Notes on a Collection of Californian Nudibranchs " : Journ. Malacol., vol. xii, pt. iii, 1905.
7. Cooper, J. G., " On New or Rare Mollusca inhabiting the Coast of California. No. II " : Proc. Californian Acad. Nat. Sci., vol. vi, pt. i, 1863.
8. MacFarland, F. M., " A Preliminary Account of the Doridida of Monterey Bay, California " : Proc. Biol. Soc. Washington, vol. xviii, 1905.
9. Ibid., " Opisthobranchiate Mollusca from Monterey Bay, California and Vicinity " : Bull. Bureau Fisheries, Washington, vol. xxv, 1906.
10. O'Donoghue, C. H., " Nudibranchiate Mollusca from the Vancouver Island Region " : Trans. Roy. Canadian Inst., vol. xiii, 1921.
11. Ibid., " Notes on the Nudibranchiate Mollusca from the Vancouver Island Region. III. Records of Species and Distribution " : Trans. Roy. Canadian Inst., vol. xiv, pt. i.
12. Stearns, R. E. C., " Descriptions of a New Genus and Two New Species of Nudibranchiate Mollusks from the Coast of California " : Proc. Calif. Acad. Sci., v, 1873.

III. On Flabellina (Æolis) iodinea, Cooper, and on Thecacera velox, Cockerell.

A. On *Flabellina* (*Æolis*) *iodinea*, Cooper.

In 1862 Cooper (5, p. 205) described briefly a species of Nudibranch from San Diego, which he termed *Æolis* (*Phidiana* ?) *iodinea*, noting

the "rich violet purple" colour, "orange red branchiæ," *i.e.* cerata, and the "orange red" rhinophores. The following year (6, p. 60) he again treated of this species, and referred it definitely to *Phidiana iodinea*.

Bergh in 1873 (1, p. 615) also dealt with it as *Phidiana iodinea*, calling attention to the slight and meagre description furnished by Cooper. Again, in 1879 (2, pp. 79–80), when he was able to examine an actual specimen, he referred it to the genus *Flabellina*, Cuvier, again noting the "violet purple" body colour, "orange rhinophores," and "orange red" cerata. He also gave a description of the radula and drawings of the teeth.

In 1901 Cockerell (3, p. 121) also described the same species, remarking on the body colour as "brilliant purple" and the rhinophores and papillæ he describes as "pale salmon colour". The description he gives of the teeth agrees closely with that of Bergh, whose paper, however, he does not mention, and he concludes that it belongs to the genus *Coryphella*, Gray.

There are several points of difference between these two genera, the most obvious being—

Coryphella.	*Flabellina.*
Rhinophores generally smooth.	Rhinophores perfoliate.
Anterior corners of foot angulated or rather produced.	Anterior corners of foot produced into tentacles.
Penis unarmed.	Penis armed with a style.

In all these points the specimen agrees with *Flabellina*, according to Bergh's account, and even Cockerell speaks of the tentacles of the foot, so that there seems little doubt that it really belongs to this genus.

The classification and synonymy of this form is, therefore :—

Genus Flabellina, Cuvier, 1830.

Species *Flabellina iodinea*, Cooper, 1862.

Synonymy : *Æolis* (*Phidiana* ?) *iodinea*, Cooper, 1862.
Phidiana iodinea, Cooper, 1863.
,, ,, Bergh, 1873.
Flabellina iodinea, Bergh, 1879.
Coryphella iodinea, Cockerell, 1901.

B. On *Thecacera velox*, Cockerell.

In Cockerell's paper in 1901 (3, p. 87) he also describes a new species of Nudibranch from La Jolla, under the name *Thecacera velox*, but he gives no references to other literature, merely remarking that it is very similar to *T. pennigera*. He again refers to the species in 1908 (4, p. 106).

The genus *Thecacera* was established in 1828 by Fleming (8, p. 283) for a species described by Montagu in 1807 (9, p. 17) as

Doris pennigera. This is the form referred to by Cockerell, and there seems little doubt that the specimen he describes is referable to the genus of which *T. pennigera* is the type. It stands, therefore :—

Genus Thecacera, Fleming, 1828.

Species *Thecacera velox*, Cockerell, 1901.

List of References.

1. Bergh, R., " Beitr. zur Kenntn. d. Æolidiaden " : Verh. k.k. Zool.-Bot. Gesell. Wien, vol. xxiii, 1873, p. 615.
2. Ibid., " On the Nudibranchiate Gasteropod Mollusca of the North Pacific Ocean, with special reference to those of Alaska. Pt. I " : Proc. Acad. Nat. Sci. Philad., 1879, pt. i.
3. Cockerell, T. D. A., " Notes on Two California Nudibranchs " : Journ. Malacol., vol. iii, No. 4, December, 1901.
4. Ibid., " Mollusca of La Jolla, California " : Nautilus, vol. xxi, No. 9, 1908, p. 106.
5. Cooper, J. G., " Some new genera and species of California Mollusca " : Proc. Calif. Acad. Nat. Sci., vol. ii, 1862.
6. Ibid., " On New or Rare Mollusca inhabiting the Coast of California. No. II " : Proc. Calif. Acad. Nat. Sci., vol. iii, pt. i, 1863.
7. Cuvier, Règne Animal., ed. 2, vol. viii, 1830, p. 35.
8. Fleming, J., " A History of British Animals," 1828.
9. Montagu, " Descriptions of several Marine Animals found on the South Coast of Devonshire " : Trans. Linn. Soc., vol. ii, 1807, p. 17.

IV. On Janolus (Æolis) barbarensis, Cooper, and on the Æolidia herculea of Bergh.

A. On *Janolus* (*Æolis*) *barbarensis*, Cooper.

Cooper in 1863 (5, pp. 59 and 60) describes a nudibranch from Santa Barbara under the name *Æolis barbarensis*. Like most of his descriptions this one is extremely brief, and hardly sufficient to enable an accurate determination of its identity to be made. He says : " Rose-red, longer tentacles tipped with yellow, branchial ciliæ simple, in six longitudinal rows, all short, the middle rows longest and tipped with blue, anterior tentacles small, above the mouth, dorsal tentacles club-shaped, a white streak extending from the median line between them to the mouth. Length nearly an inch."

Later, Cockerell and Eliot in 1905 (4, pp. 48–50) describe a form from Dead Man's Island, San Pedro, giving it the name *Janolus cœruleopictus*. The account was based upon a preserved specimen, and the authors state that the rhinophores are " large, stout, almost spherical ", which means that in the living condition and slightly extended they would be close to Cooper's " dorsal tentacles club-shaped ". The same authors also say : " the anterior end of the animal somewhat distorted, but there appears to have been a fold over the mouth with a distinct cylindrical tentacle on each side " ; and, again, this seems to correspond with Cooper's " anterior tentacles small, above the mouth ". Thus Cooper's form was probably a *Janolus*.

The latter author describes the colour as "rose-red", while Cockerell and Eliot picture it as tawny yellow, perhaps sufficiently near to be within the limits of variation. The striking point, however, is Cooper's statement that the larger cerata are tipped with blue, which agrees exactly with the figures in Cockerell and Eliot, who show the larger cerata with blue tips, which the smaller cerata lack. It seems very probable from the evidence furnished above that the forms are identical, particularly when it is borne in mind that they come from approximately the same area, and are the only forms so far recorded from the whole coast with blue-tipped cerata. Sir Charles Eliot informs me that he is inclined to agree with this decision. The animal thus stands as *Janolus barbarensis*, Cooper.

The classification and synonymy is therefore :—

Family JANIDÆ.

Genus JANOLUS, Bergh, 1884.

Species *Janolus barbarensis*, Cooper, 1863.

Synonymy : *Æolis barbarensis*, Cooper, 1863.
Janolus cœruleopictus, Cockerell & Eliot, 1905.

B. On the *Æolidia herculea* of Bergh.

Bergh in 1894 described a form as *Æolidia herculea*, and gave a moderate account of its anatomy. He concludes : "Diese Form scheint durch die Form der Kiefer von der in pacifischen Ocean vorkommenden Varietät der *Æ. papillosa* verschieden ; vielleicht ist sie aber auch nur eine local Varietät" (3, p. 129).

There appears to be no difference in other respects. If one examines the figure of the mandible of *Æolidia papillosa* given by Bergh in 1879 (1, pl. i, fig. 1) and that of *Æolidia herculea* by the same author in 1894 (3, pl. i, fig. 8), it will be found practically impossible, allowing for the slightly different style of drawing and size, to distinguish between them. In his description of *Æ. herculea* he states it is "gerundet und gewölbt wie bei keiner der anderen bisher bekannten ächten Æolidien". The difference, however, is not sufficient to show in camera lucida drawings.

In view of Bergh's proclivity for creating species and varieties without sufficient justification, I have no hesitation in identifying these two forms as one and the same species. It should stand, therefore :—

Family ÆOLIDIDÆ.

Genus ÆOLIDIA, Cuvier, 1798.

Species *Æolidia papillosa*, Linnæus.

Synonym *Æolidia herculea*, Bergh.

LIST OF REFERENCES.

1. Bergh, R., "On the Nudibranchiate Gasteropod Mollusca of the North Pacific Ocean, with special reference to those of Alaska. Pt. I." : Proc. Acad. Nat. Sci. Philad., 1879, pt. i.

2. Ibid., "Report on the Nudibranchiata": Challenger Expedition, vol. x, 1884.
3. Ibid., "Die Opisthobranchien" from "Reports on the Dredging Operations off the West Coast of Mexico, and in the Gulf of California in charge of Alexander Agassiz carried on by the U.S. Fish Commission Steamer 'Albatross' during 1891": Bull. Mus. Comp. Zool. Harvard, vol. xxv, No. 10, October, 1894.
4. Cockerell, T. D. A., and Eliot, C., "Notes on a Collection of Californian Nudibranchs": Journ. Malacol., vol. xii, 1905.
5. Cooper, J. S., "On New or Rare Mollusca inhabiting the Coast of California. No. II": Proc. Calif. Acad. Nat. Sci., vol. iii, pt. i, 1863.

V. On the Family Doriopsidæ (Doridopsidæ).

Pease in 1860 (19, p. 32) created a new genus which he termed *Doriopsis*, but the definition that he gave was not a very concise one. Four years later Alder and Hancock (2, pp. 124–130) established another genus *Doridopsis*, and in view of its peculiar characters separated it off as a distinct family, the Doridopsidæ. It is closely allied to the Doridida, but among other differences is decidedly noteworthy in lacking a radula, while this organ is well developed in the other family. This raising to family rank was adopted by Hancock in 1865 (16, pp. 189–207) and by all subsequent workers. Pease in 1871 (20, p. 279) reaffirmed his genus *Doriopsis*, maintaining that it was slightly different from that of Alder and Hancock, and proposed for the latter the name *Haustellodoris*. As Bergh points out, however (1875, pp. 82–94), there is not much doubt that all Pease's species would fall within Alder and Hancock's genus, a statement with which Abraham (1, p. 240) is in agreement. Thus what Alder and Hancock virtually did was to redefine the genus more accurately. The validity of the genus and family is not now questioned, but the name appears in dispute. It is obvious that Pease's name has priority, and it was adopted by Bergh in a series of papers from 1875 to 1884 (3–8). Abraham (1, p. 240) adopts Alder and Hancock's name, stating: "We cannot follow him (*i.e.* Bergh) in adopting 'Doriopsis' as the generic name, not only because none but Mr. Pease's own species, about which we cannot always feel sure, will fall under that species as defined by him, but also because the root of 'Doris' is 'Dorid' and not 'Dori', so that 'Doridopsis' is more correct etymologically than 'Doriopsis'." Eliot (13, p. 660, and 14, p. 7, etc.) also employs the former of these two names.

In answer to the first of Abraham's objections, it may be pointed out that it not infrequently happens that the definition of a genus as originally given has to be modified, usually to exclude but sometimes to include other forms. The second is not a strong objection either, for we are not, it may be unfortunately, primarily concerned with questions of etymology, and it would not be difficult to cite cases where the names of genera and species are etymologically incorrect.

It seems obvious that the constituent species of the two genera are almost identical or, at any rate, can be made so by a slight

change of definition; indeed, if *Doridopsis* be used, *Doriopsis* disappears as a genus. Secondly, *Doriopsis* has been adopted subsequently by a number of workers, e.g. Bergh (3–8), Farran (15), MacFarland (17 and 18), Vayssière (21), and others. On the whole, then, it seems advisable to retain the term *Doriopsis*, originally used by Pease, with its definition amended, and employ it in the sense used by Bergh in 1880 (6).

The latter author in this paper added to the family a new and closely allied genus *Doriopsilla*, which has since been accepted. In this connexion it is to be noticed that if the second of Abraham's objections has weight, then this genus should be termed "Doridopsilla", a proceeding that no one has suggested.

The following species from the Pacific Coast of North America have been referred to the family.

In 1803 Cooper (12, p. 58) described a form under the name of ? *Doris albopunctata*, and later in 1905 (10, p. 41) Cockerell and Eliot describe a *Doridopsis reticulata*, but at the same time point out that it is probably identical with Cooper's form. If this be the case, as seems not improbable, then the name of the animal should have been given as *Doriopsis albopunctata*. However, a re-examination of specimens convinced Eliot later (13, p. 660) that it really belongs to the genus *Doriopsilla*, so that the name stands as *Doriopsilla albo-punctata*, with Cockerell and Eliot's name *D. reticulata* as a synonym.

These two authors (10, p. 46) also describe a *Doridopsis vidua* (?), which they point out is probably identical with the *D. vidua* of Bergh, 1878, but if it should prove distinct they propose for it the name *D. nigromaculata*. In a list provided by Cockerell in 1908 (9, p. 106), this author gives *D. nigromaculata* (? = *vidua*, Bergh), but obviously if it is = *vidua*, Bergh, then it is *Doriopsis vidua*, and *D. nigromaculata* is only a synonym.

Lastly, we have MacFarland in 1905 (17, p. 245) and 1906 (18, p. 130) describing a *Doriopsis fulva*.

Cooper in 1862 (11, p. 204) described a species as *Doris* (*Actinocyclus*) *sandiegensis*, and this Abraham (1, p. 246) suggests should probably be regarded as *Doridopsis sandiegensis*. This, however, was afterwards shown by Bergh, 1880 (7*a*, p. 41), to be *Diaulula sandiegensis*, an identification about which there seems to be no doubt. The members of this family are, therefore :—

Family DORIOPSIDÆ.

Genus Doriopsis, Pease, 1860.

Species : *Doriopsis fulva*, MacFarland, 1905.

Doriopsis vidua, Bergh, 1878 (recorded from California by Cockerell and Eliot, 1905).

Synonym : *D. nigromaculata*, Cockerell and Eliot, 1905.

If *D. nigromaculata* should ever be shown to be a separate species, then the two names would stand.

Genus Doriopsilla, Bergh, 1880.

Species *Doriopsilla albopunctata*, Cooper, 1863.

Synonymy : ? *Doris albopunctata*, Cooper, 1863.
Doridopsis reticulata, Cockerell & Eliot, 1905.
Doriopsilla reticulata, Eliot, 1906.
If *D. reticulata* should ever be shown to be a separate species, then the two names would stand.

List of References.

1. Abraham, P. S., "Revision of the Anthobranchiate Mollusca, with Descriptions or Notices of forty-one hitherto undescribed Species": Proc. Zool. Soc., 1877, pp. 196–267.

2. Alder and Hancock, "Notice of a Collection of Nudibranch Mollusca made in India by W. Elliot": Trans. Zool. Soc., vol. v, 1864, pp. 124–130.

3. Bergh, R., "Neue Nacktschnecken der Sudsee I.": Journ. Mus. Godeff., Hft. viii, 1875, pp. 82–94.

4. Ibid., Malacol. Untersuch., Heft x, pp. 384–387, Semper's Reisen im Archipel der Philippinen, Thl. ii, Bd. ii, 1875.

5. Ibid., "Die Doriopsen des Atlant. Meeres": Jahrb. Deutsch Malac. Gesell., Bd. vi, 1879, pp. 42–64.

6. Ibid., "Die Doriopsen des Mittelmeeres": Jahrb. Deutsch Malac. Gesell., Bd. vii, 1880, pp. 297–328.

7. Ibid., Malacol. Untersuch. Supplement, Heft i, pp. 9–13 : Semper's Reisen im Archipel der Philippinen, Thl. ii, Bd. ii, 1880.

7*a*. Ibid., "On the Nudibranchiate Gasteropod Mollusca of the North Pacific Ocean, with special reference to those of Alaska": Proc. Acad. Nat. Sci. Philad., 1879 and 1880.

8. Ibid., "Report on the Nudibranchiata dredged by H.M.S. *Challenger* during the years 1873–6" (p. 117): Challenger Reports, Zoology, vol. x (pt. xxvi), 1884.

9. Cockerell, T. D. A., "Mollusca of La Jolla, California": Nautilus, vol. xxi, 1908, pp. 106–107.

10. Cockerell & Eliot, "Notes on a Collection of Californian Nudibranchs": Journ. Malacol., vol. xii, 1905, pp. 31–53.

11. Cooper, J. C., "Some new genera and species of Californian Mollusca": Proc. Calif. Acad. Nat. Sci., vol. ii, 1862, pp. 202–205.

12. Ibid., "On New or Rare Mollusca inhabiting the Coast of California. No. II": Proc. Calif. Acad. Nat. Sci., vol. iii, 1863, pp. 56–60.

13. Eliot, C., "On the Nudibranchs of Southern India and Ceylon with special reference to the Drawings by Kelaart and the Collections belonging to Alder and Hancock preserved in the Hancock Museum at Newcastle-on-Tyne": Proc. Zool. Soc., 1906, p. 660.

14. Ibid., "A Monograph of the British Nudibranchiate Mollusca": pt. viii, Supplementary [Ray Soc.], 1910.

15. Farran, G. P., "Report on the Opisthobranchiate Mollusca collected . . . at Ceylon": Report III on the Pearl Oyster Fisheries of the Gulf of Manaar [Ray Soc.], pt. iii, Supp. Rept. 21, 1905.

16. Hancock, A., "On the anatomy of *Doridopsis*": Trans. Linn. Soc. London, vol. xxv, 1865, pp. 187–207.

17. MacFarland, F. M., "A Preliminary Account of the Dorididæ of Monterey Bay, California": Proc. Biol. Soc. Washington, vol. xviii, 1905.

18. Ibid., "Opisthobranchiate Mollusca from Monterey Bay, California and Vicinity": Bull. Bureau Fisheries, Washington, vol. xxv, 1906.

19. Pease, W. H., "Descriptions of New Species of Mollusca from the Sandwich Islands": Proc. Zool. Soc. Lond., 1860.

20. Ibid:, " Descriptions of Nudibranchiate Mollusca inhabiting Polynesia " : Amer. Journ. Conchol., vol. vi, 1871, p. 299.
21. Vayssière, A., " Recherches zoologiques et anatomiques sur les Opisthobranches de la Mer Rouge et du Golf d'Aden " : Ann. Fac. Sci. Marseilles, vol. xx, supp., 1912.

VI. On Fiona marina, Forskål.

The history of the nomenclature of the species now known as *Fiona marina* is a varied one, and has not, I think, been fully set forth. It is of interest since it is one of the first three forms to be recorded from this region.

One of the first nudibranchs to be described in a manner that enabled it to be recognized subsequently was *Limax marinus*, which was reported by Forskål (17, p. 99) in 1775.

Van Hasselt, in a letter to Professor van Swinderen dated 25th May, 1823, from Tjuringe, Java, but first published in 1824 (18, p. 22, and 19, p. 238), described what he presumed to be a new species *Eolidia alba*.

Eschscholtz (15, p. 14) in 1831, furnishing the first account of the Nudibranchs from the Pacific Coast of North America, included the record of an *Eolidia pinnata*, examples of which were collected by Captain von Kotzebue at Sitka, Alaska, in 1824.

Quoy et Gaimard (20, p. 288), in 1832, described an *Æolis longicauda* from New Zealand waters. In 1857 Alder and Hancock (1, p. 291) recorded a new form which they termed *Oithona nobilis*, and claimed it not only as a new species, but also as the type of a new genus. In Forbes and Hanley's " British Mollusca " (16, p. x) we find a footnote : " Mr. Alder and Mr. Hancock inform us of their intention to substitute the generic name *Fiona* for *Oithona* (Fam. Eolididæ), the latter appellation having been previously employed by Dr. Baird for a genus of Entomostraca." This was established more permanently by these two writers in 1855 (3, pp. 52–53). In the latter paper, also, they made it not only the type of a genus but also of the Family Fionidæ, an arrangement subsequently accepted and adopted by Eliot (14, pp. 75 and 166) in 1910.

The establishment of the genus *Fiona* was also accepted by Bergh, when in 1858 (4) he described a form as *Fiona atlantica*, and again in 1859 (5) and in his subsequent papers. Generic rank is undoubtedly deserved by these forms, since, while they resemble the Æolidida superficially, they differ in certain important respects and are easily recognizable. The genus is to be distinguished by the presence of a gill lamella or membrane running down the side of each of the cerata ; the anus is dextro-dorsal in position ; the apertures of the genital ducts are separate ; the dorsal margin forms a rudimentary flap ; the jaws are denticulate ; the radula is uniseriate, and the oral tentacles are set far back.

In 1866 (13, iii, pp. 64–80) and in 1867 Costa (13, iv, p. 28) described a species from the Mediterranean Sea under the name *Hymenœolis elegantissima*, but this is obviously a *Fiona*.

It appears probable, however, that all these names have been given to one and the same species. Bergh in 1879 (8, p. 86) gives as synonyms *L. marinus*, *F. nobilis*, *F. atlantica*, and *H. elegantissima*. Eliot, again (14, p. 166), in 1910, regards *L. marinus*, *F. nobilis*, and *F. atlantica* as identical.

Bergh also, in 1879 (8, p. 86), in 1884 (9, p. 9), and again in 1894 (11, pp. 130–131), also suggests that *Eolidia pinnata*, Esch., *Æolis longicauda*, and *E. alba* are also to be regarded as synonymous. The last of these is apparently still somewhat doubtful, for the same author says of it in 1887 (10, p. 310): "Diese, von van Hasselt durch zwei Figuren illustrierte Form, lässt sich weder durch den Text, noch durch die Figuren generich bestimmen; vielleicht konnte sie einen *Proctonotus* darstellen." The same author includes as synonyms his own *Fiona pinnata* of 1873 (6) and 1874 (7). Further, in 1879 (8, p. 86) and in 1894 (11, p. 130) he terms the species on the Pacific Coast *F. marina* var. *pacifica*. But as far as can be ascertained from these accounts, the animals are fairly typical examples of *F. marina*, and the addition of var. *pacifica* does not indicate any particular variety of form, but simply that they came from the Pacific Coast.

If the foregoing identifications are correct, as seems probable in all save that of *E. alba*, van Hass., then *Fiona marina* is one of the most widely distributed species known and, for most areas, one of the earliest recorded forms. It is known from the Indian Ocean, the Atlantic Coast of North America, the Pacific Coast of North America from Alaska and California, the Australian Seas, the New Zealand Seas, the Japanese Seas, the Madagascar Seas, the European Seas, the Eastern Atlantic and the Mediterranean Sea.

As the result of Casteel's work, its larval development is more fully known than is that of other nudibranch.

Its synonymy is, therefore, as follows:—

Family FIONIDÆ, Eliot, 1910.

Genus Fiona, Alder and Hancock, 1853 and 1855.

Species *Fiona marina*, Forskål, 1775.

Synonymy: *Limax marinus*, Forskål, 1775.
Eolidia alba, van Hasselt, 1824.
Eolidia pinnata, Eschscholtz, 1831.
Æolis longicauda, Quoy et Gaimard, 1832.
Oithona nobilis, Alder and Hancock, 1851.
Fiona nobilis, Alder and Hancock. 1853.
Fiona nobilis, Alder and Hancock, 1855.
Fiona atlantica, Bergh, 1858.
Hymenœolis elegantissima, Costa, 1866.
Fiona pinnata, Bergh, 1873 and 1874.
Fiona marina var. *pacifica*, Bergh, 1879–1894.
Fiona marina, Casteel, 1904.
Fiona marina, Eliot, 1910.

For some reason or other Bergh (11, p. 130) gives the founders of this genus and species as Hancock and Embleton, and later also Eliot (14, p. 166), while he ascribes the genus to Alder and Hancock, puts the specific name *F. nobilis* down to Hancock and Embleton. Both of these, as far as I can see, are slips, and Alder and Hancock are responsible for both the specific and generic names.

List of References.

1. Alder & Hancock, " Descriptions of two new Species of Nudibranchiate Mollusca, one of them forming the Type of a New Genus " : Ann. & Mag. Nat. Hist., ser. II, vol. viii, 1851, p. 291.
2. Ibid., in Forbes and Hanley's " British Mollusca ", vol. iii, 1853, p. x.
3. Ibid., " *Fiona nobilis* " : Mon. British Nudibr. Moll. [Ray Soc.], pt. vii, 1855, pp. 52–53, Fam. 3, pl. 38*a*, App. xxiii.
4. Bergh, R., " Anatomisk. Untersögelse af *Fiona atlantica* " : Vidensk. Meddel. nat. Foren. Kjoben., 1857, p. 273.
5. Ibid., " Contributions to a Monography of the genus *Fiona* " [a translation of the preceding], 8vo, Copenhagen, 1859.
6. Ibid., Journ. Mus. Godeffroy, Hft. ii, 1873, p. 87.
7. Ibid., Verh. k.k. Zool.-bot. Gesell. Wien, Bd. xxiii, 1874, pp. 606–610.
8. Ibid., " On the Nudibranchiate Gasteropod Mollusca of the North Pacific Ocean, with special reference to those of Alaska " : Proc. Acad. Nat. Sci. Philadelphia, 1879.
9. Ibid., " Report on the Nudibranchiata " : Challenger Reports, Zoology, vol. x (pt. xxvi), 1884.
10. Ibid., " Die van Hasselt'schen Nudibranchien " : Notes Leyden Museum, vol. ix, 1887.
11. Ibid., " Die Opisthobranchien " from " Reports on the Dredging Operations off the West Coast of Mexico, and in the Gulf of California in charge of Alexander Agassiz carried on by the U.S. Fish Commission Steamer ' Albatross ' during 1891 " : Bull. Mus. Comp. Zool. Harvard, vol. xxv, No. 10, 1894.
12. Casteel, D. B., " The Cell-lineage and Early Larval Development of *Fiona marina*, a Nudibranchiate Mollusk " : Proc. Acad. Nat. Sci. Philad., 1904.
13. Costa, Ann. Mus. zool. Napoli, iii, 1866 ; and iv, 1867.
14. Eliot, C., " A Monograph of the Brit. Nudibr. Moll." : [Ray Soc.], pt. viii, Suppt., 1910.
15. Eschscholtz, F., " Zoologischer Atlas, 1829–1823," Heft iv, 1831.
16. Forbes & Hanley, " History of British Mollusca," vol. iii, p. x, 1853.
17. Forskål, Descript. Animal., 1775, p. 99, Icon. Animal., xxvi, fig. G. 9.
18. van Hasselt, J. C. (reported by Th. van Swinderen), " Bejdrage tot eene schets van het leven, het karakter en de verdiensten van wÿlen Dr. J. C. van Hasselt " in Genootschap ter bevordering der. naturr. hist. te Groningen : Almanak der Akad van Groningen, xiii, 1825, pp. 1–67.
19. Ibid., " Extrait d'une lettre du J. C. van Hasselt au Prof. van Swinderen, sur les Mollusques de Java " : Bull. sc. nature et de géol., iii, 1824. And also " Extrait d'une lettre de van Hasselt, datée de Buitenzorg (île de Java), le 12 âout 1821, sur les Biophores " : Annales d. Sci. Nat., T. iii, 1824.
20. Quoy et Gaimard, Voyage de . . . l'Astrolabe. Zool., Tom. ii, 1832.

VII. On Melibe (Chioræra) leonina, Gould.

This striking and interesting form was first described by Gould in 1852 (7, p. 310) from Puget Sound, and this account quoted by

Adams (1, p. 71) in November, 1854. Cooper in 1863 (5, p. 60) recorded a form from Santa Barbara, which he thinks is probably the *C. leonina* of Gould, and he gave a short description of it. This account, however, is so imperfect that the identity of the animal is doubtful: it cannot be referred to any other form and appears to belong to the genus, so that it probably does represent *C. leonina*.

It was mentioned again in 1888 by Fewkes from Monterey, as *Chiorœa leontina* [*sic*] (6, p. 45). In 1904 Bergh (9) described a *Melibe pellucida* from the coast of Washington, near the mouth of the Columbia River. He also gives an incomplete description of it, but so far as he goes there seems to be no reason for separating it from the forms previously described, and so his name is to be regarded as a synonym.

Heath in "The Anatomy of an Eolid, *Chiorœra dalli*" in 1917 (8, pp. 137–148) describes as a new species a form which he separates from the *C. leonina* of Gould, on the ground of the lack of a lamellated rhinophore clavus. It is recorded from Rose Inlet, Dall Island, South-eastern Alaska; from Hecate Strait, Prince of Wales Island; and from Echo Harbour and Sewell Inlet, Queen Charlotte Islands. This paper deserves some consideration, since it is the first detailed account of a member of the genus from the Pacific Coast of North America. In the first place, the term "Eolid" in the title is used very loosely, for the animal is not a member of the genus *Æolidia*, nor of the family Æolididæ, but undoubtedly falls in the family Tethymelibidæ. The author, strangely enough, does not appear to have paid the least attention to any other paper, save that of Gould, and yet various members of the family have been dealt with by a number of authorities on the group. At the bottom of p. 143 he refers to what he terms the "otocyst", but even from his imperfect description it is obvious that he is dealing with the eye.

The rest of the account of the structure, habits, and habitat of the animal agrees in practically all its details with the form described by Gould as *Chiorœra leonina*. He appears to have been unfortunate in his examination of the alimentary canal, which he always found empty save in one case, where a few diatoms were present. It is not at all uncommon to find the gizzard full of small crustaceans (Copepoda, Amphipoda, etc.), a fact that Kjerschow-Agersborg has also pointed out (9, p. 272, and 10, p. 229).

The sole difference upon which Heath erects his species is that "Unlike *Chiorœra leonina*, the dorsal tentacles are not retractile, and in preserved material are plain, muscular, foliaceous outgrowths. Gould states that the tentacles of *C. leonina* bear on their anterior margin 'an opaque, whitish papilla, presenting something of a spiral or lamellar structure'. Nothing of the kind has been found to exist in the present species".

Gould's description of the species is vague in several respects, but when he says the "cephalic tentacles foliate, retractile", he is

not referring to the "foliaceous outgrowths" as Heath appears to suggest. He is using a well-known technical description of the clavus of the rhinophore when he says it is "foliate". This is the "white papilla" with a "lamellar structure". The species bears on the cowl two foliaceous outgrowths which are extremely modified rhinophore stalks, and at the antero-median corner of each of these is a small, retractile, foliate clavus with six or seven very low leaves, which when partially extended appears superficially to be somewhat spiral in shape. When this is fully retracted the whole clavus and sheath simply forms a tiny thickening about 2–2·5 mm. by 1–1·5 mm. on the edge of the large appendage, and is very easily missed. It seems highly probable that Heath overlooked this structure, and it is interesting to note in this connexion that he actually figures a nerve (pl. xi, c4), calling it the "tentacular nerve", which, if he had followed it completely, would have been found to send its main branch to the clavus. That this organ can readily escape notice I know from my own experience, since in my description of the external characters of this species I also overlooked this tiny clavus.

It would appear, then, that *C. dalli* cannot be admitted as a valid species without confirmation, and with this view Professor F. M. MacFarland is in agreement for, at any rate, some of the reasons given above.

Kjerschow-Agersborg in 1919 (9, p. 269) and again in 1921 (10, p. 222) deals with the animal from Puget Sound as *Melibe leonina*. The present writer in the same year as the latter also furnished a description of this species from Vancouver Island (11, p. 192), using the name *Chiorœra leonina*, which was employed again later (12, p. 165).

The genus *Melibe* was established by Rang in 1829 (13, pp. 129–130), and the same term was employed by Bergh in 1875 (2, pp. 362–376) and in a series of subsequent papers, particularly one in 1907, where he actually refers the *Chiorœra leonina* of Gould to this genus (4, p. 96).

In my previous papers I had not access to the complete literature of Bergh, and so I placed the form back in the genus *Chiorœra*. Re-examination of the question in the light of the further details adduced by Kjerschow-Agersborg, however, leads me to think that there is no valid reason why this species should not be referred to the genus *Melibe*, the name of which has priority over *Chiorœra*, and with this conclusion Professor F. M. MacFarland informs me he is in entire agreement.

The family Tethymelibidæ, so far as at present recorded, is represented by one species from the area under consideration. This form is widely distributed from South-eastern Alaska down to Santa Barbara, and has probably been taken from a wider range of localities than any other Nudibranch on the coast.

It stands, therefore :—

Genus Melibe, Rang, 1829.

Species *Melibe leonina*, Gould, 1852.

Synonymy : *Chiorœra leonina*, Gould, 1852.
Chiorœra leonina, Adams, 1852.
Chiorœra leonina, Cooper, 1863.
Chiorœa leontina, Fewkes, 1888.
Melibe pellucida, Bergh, 1904.
Melibe leonina, Bergh, 1908.
Chiorœra dalli, Heath, 1917.
Melibe leonina, Kjerschow-Agersborg, 1919–21.
Chiorœra leonina, O'Donoghue, 1921.

List of References.

1. Adams, H. & A., " Genera of Recent Mollusca," vol. ii, 1854–58.
2. Bergh, R., Malacol. Untersuch., Heft x, Semper's Reisen im Archipel der Philippinen, Thl. ii, Bd. ii, 1875.
3. Ibid., Malacol. Untersuch., Thl. vi, Heft i, Semper's Reisen im Archipel der Philippinen, Thl. ii, Bd. ix, 1904.
4. Ibid., " The Opisthobranchiata of South Africa " : Trans. S. Afric. Phil. Soc., vol. xvii, 1907.
5. Cooper, J. G., " On New or Rare Mollusca inhabiting the Coast of California. II " : Proc. Calif. Acad. Nat. Sci., vol. iii, pt. i, 1863.
6. Fewkes, J. W., " New Invertebrata from the Coast of California " : Boston, 1889.
7. Gould, A. A., U.S. Exploring Expedition, vol. xii, Molluscs and Shells, 1852.
8. Heath, H., " The Anatomy of an Eolid *Chiorœra dalli* " : Proc. Acad. Nat. Sci. Philad., vol. lxix, 1917.
9. Kjerschow-Agersborg, K. P., " Notes on *Melibe leonina* " : Pub. Puget Sound Biol. Station, vol. ii, 1919.
10. Ibid., " Contributions to the knowledge of the Nudibranchiate Mollusk, *Melibe leonina* (Gould) " : Amer. Nat., vol. lv, 1921.
11. O'Donoghue, C. H., " Nudibranchiate Mollusca from the Vancouver Island Region " : Trans. Roy. Canadian Inst., vol. xiii, 1921.
12. Ibid., " Notes on the Nudibranchiate Mollusca from the Vancouver Island Region. III. Records of Species and Distribution " : Trans. Roy. Canadian Inst., vol. xiv, pt. i, 1922.
13. Rang, S., Manuel de l'Hist. nat. des Mollusques, 12°, Paris, 1829.